12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug . Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a poring box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer

US005546281A

United States Patent [19]

Poplawski et al.

[11] Patent Number: 5,546,281

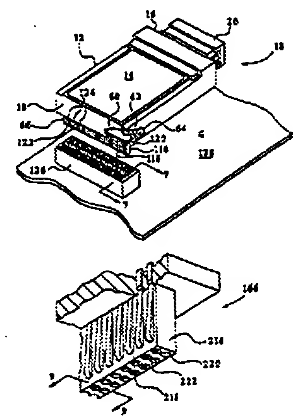
[45] Date of Patent: Aug. 13, 1996

[54] REMOVABLE OPTOELECTRONIC MODULE

[37] ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly.

17 Claims, 3 Drawing Sheets



EAST Browser - L2: (92) plug same op... | JP 10133791 A | Tag: S,T1 | Doc: 83/92 | "Full" 1/8 (Total images 8)

PAT-NO: JP410133791A

DOCUMENT-IDENTIFIER: JP 10133791 A

TITLE: OPTICAL RADIO TRANSMISSION DEVICE, INTERFACE, AND PORTABLE INFORMATION TERMINAL

PUBN-DATE: May 22, 1998

INVENTOR-INFORMATION:
NAME
NARISAWA, KENJI

ASSIGNEE-INFORMATION:

NAME	COUNTRY
VICTOR CO OF JAPAN LTD	N/A

APPL-NO: JP08302431

APPL-DATE: October 28, 1996

INT-CL (IPC): G06F003/00, H04B010/105 , H04B010/10 , H04B010/22

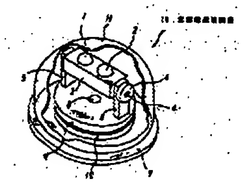
ABSTRACT:

PROBLEM TO BE SOLVED: To provide an optical radio transmission device, interface, and portable information terminal which make it easy to connect an electronic device such as a personal computer to a LAN(local area network)

SOLUTION: The optical radio transmission device 15 has a light emitting element 1 and a light receiving element to send and receive data with light, and also has optical transmission and reception parts which are arranged having their optical transmission and reception directions set to the same direction, driving devices 6 and 10 which can adjust the optical transmission and reception directions of the optical transmission and reception parts with a specific three- dimensional angle range, and a direction control part which controls the driving devices so that the optical transmission and reception parts have maximum optical transmission and reception intensity. Further, the interface has the optical radio transmission device mounted on a plug -in card.

(12) 公開特許公報 (A)

特開平10－133791



転するが、プラグ２側の光ファイバー心線１の端面は、受・発光面６ｂが円環状であるために常に受・発光面６ｂに対向する。このため、固定機器からの電気信号は、光ファイバーの心線１の端面及び受・発光ダイオード４、６におけるＥ／Ｏ変換を経てドラムＤのケーブル１０に確実に伝達される。又、逆に光ファイバーケーブル心線１からの光信号は、それを受光ダイオード４、６が受けＯ／Ｅ変換されてケーブル１０′に伝達される。

なお、プラグ２側に受・発光ダイオード６を固着するようにしてもよい。

また、実施例において、受・発光ダイオード４、６を中心から発光ダイオード、受光ダイオードと適宜に選択して配置すれば、送信と受信の双方向伝達をすることができる。

さらに、受・発光素子ａの配置態様としては、実施例以外に、固定側をＡ又はＢ、回転側をＢ又はＡとすると、例えば、第４図(a)、(b)、(c)など種々考えられる。

〔発明の効果〕

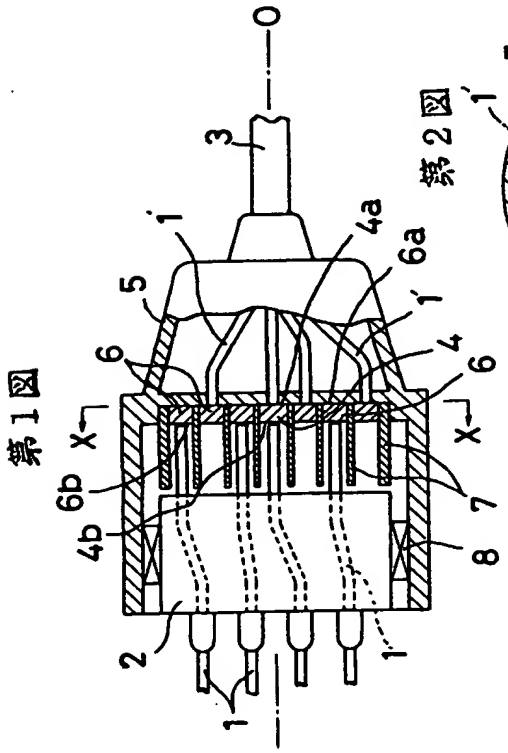
以上説明した如く、本発明の多心光ロータリーコネクターによれば、コネクター自身がＯ／Ｅ、Ｅ／Ｏ変換機能を併せもっているので、別途に、Ｏ／Ｅ、Ｅ／Ｏ変換器あるいは合波器、分波器を必要とせず、伝送系全体の設備費用を安価にすることができるうえに、光軸のずれが生じた場合でも伝送影響を少なくし得て、ロータリーコネクターの寿命も長くする事ができる等の効果を有する。

４．図面の簡単な説明

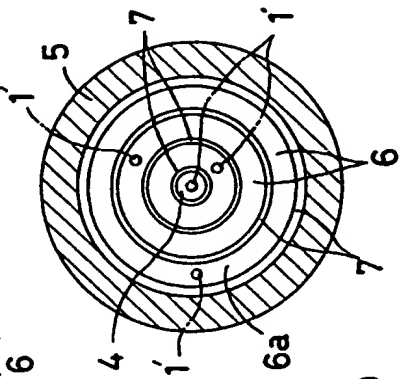
第１図は本願発明に係る多心光ロータリーコネクターの一実施例の断面図、第２図は第１図のＸ－Ｘ線断面図、第３図は同実施例の使用説明図、第４図(a)～(c)は他の各実施例の概略図である。

１……光ファイバー心線、１′……リード線、２……プラグ、５……レセプタクル、６……円環状面受・発光ダイオード、７……遮蔽板、１０……光ケーブル、６ｂ……受・発光面。

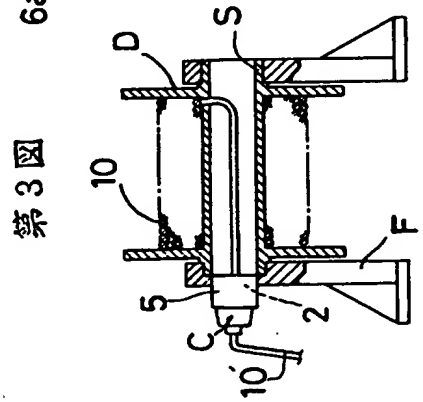
第１図



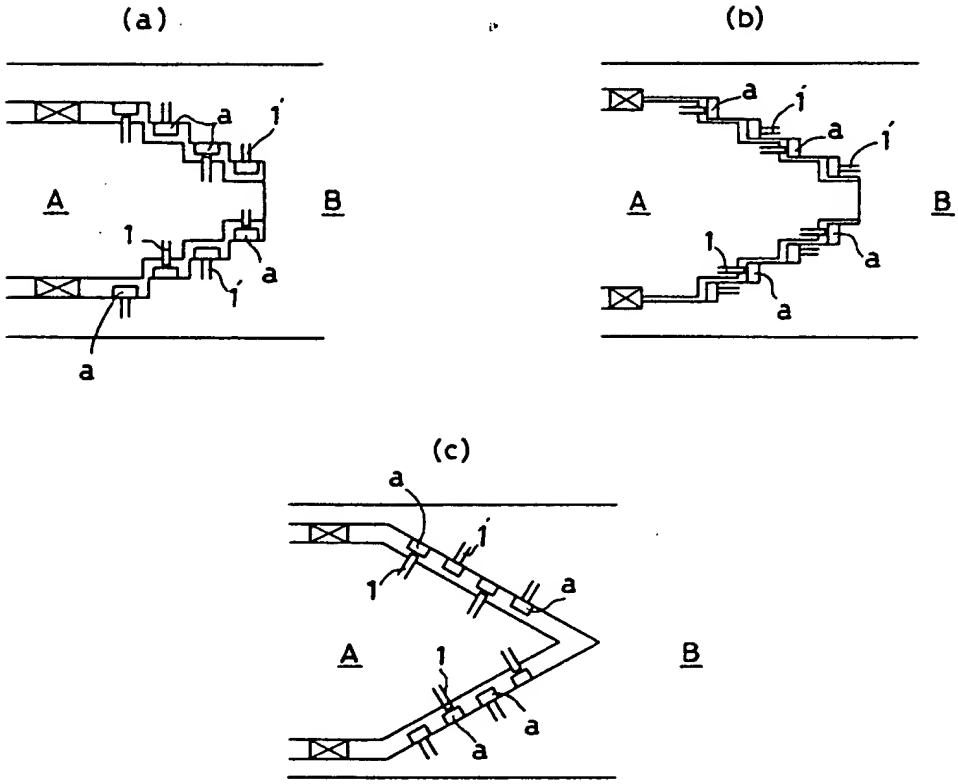
第２図



第３図



第4図



a plurality of plug-in connectors provided on said rear panel at an inner side thereof in electrical connection with said interconnection pattern;

an optical telecommunication apparatus carrying a plurality of plug-in connectors, said optical telecommunication apparatuses being provided such on said rear panel such that said plug-in connectors of said optical telecommunication apparatus establish a removal engagement with corresponding plug-in connectors on said rear panel;

a plurality of interface connectors provided on said rear panel, each of said interface connectors including a plurality of interconnection pins studded on said rear panel in electrical contact to said interconnection pattern and a protective shroud provided on an outer side of said rear panel so as to surround said interconnection pins, said interconnection pins extending outwardly from said rear panel in each of said interface connectors for accepting an external connector, said protective shroud being adapted for guiding said external connector for insertion to and removal away from said interface connector; and

a rear cover provided on said shielded case so as to cover said rear panel, said rear cover carrying a plurality of openings for exposing said interface connectors;

said rear cover being adapted for carrying a shield cover plate at an outer side thereof for shielding one or more of said openings.

2. The optical telecommunication unit as claimed in claim 1, wherein said optical apparatus includes a plurality of plug -in units each adapted for a removable insertion to said plug -in connector on said rear panel through said front opening of said shielded case, said plug -in units including: a photoreception unit for receiving an optical transmission of a work channel and further an optical transmission of a protect channel; a switch unit including a plurality of switch circuit boards each adapted for a removable insertion to a corresponding plug -in connector on said rear panel, said switch unit thereby switching incoming signals, and an optical transmission unit for sending out an optical output signal for a work channel and an optical output signal for a protect channel.

3. The optical telecommunication unit as claimed in claim 1, further including a shield cover plate provided removably on said rear cover so as to cover one or more of said openings of said rear panel.

4. The optical telecommunication unit as claimed in claim 1, wherein said rear panel includes a plurality of layers each carrying a conductor pattern, and wherein said interconnection pins are press-fit into said rear panel in electrical contact to one of said conductor patterns.

5. The optical telecommunication unit as claimed in claim 1, wherein said rear panel carries a shielding conductor layer on a rear exposed surface thereof and a front exposed surface thereof.

6. The optical telecommunication unit as claimed in claim 1, further including a blower unit provided on said shielded case underneath said optical telecommunication apparatus for cooling said plug-in units and an optical terminal unit provided on said shielded case above said optical telecommunication apparatus for optical connection to an incoming optical fiber cable and an outgoing optical fiber cable.

7. The optical telecommunication unit as claimed in claim 2, wherein said plurality of plug-in units are arranged in the form of a lower first shelf and

US005909298A

United States Patent [19]
Shimada et al.

[11] **Patent Number:** 5,909,298
[45] **Date of Patent:** Jun. 1, 1999

[54] OPTICAL TELECOMMUNICATION APPARATUS FOR USE IN AN OPTICAL RING NETWORK

[73] Assignee: Fujitsu Limited, Kanagawa, Japan

[22] Filed: Feb. 24, 1997

[30] Foreign Application Priority Data

[56] References Cited

U.S. PATENT DOCUMENTS

[57] ABSTRACT

An optical telecommunication unit includes a shielded case having a size adapted for mounting upon a standard open-rack frame, wherein the shielded case includes a rear panel carrying an interconnection pattern, a plurality of plug-in connectors provided on the rear panel at an inner side thereof in electrical connection with the interconnection pattern for holding plug-in units forming an optical telecommunication apparatus inside the optical telecommunication unit, wherein the optical telecommunication unit carries a plurality of interface connectors on the rear panel in electrical connection with the interconnection pattern for accepting external interconnection cables, and a rear cover is provided on the shielded case so as to cover the rear panel.

15 Claims, 48 Drawing Sheets

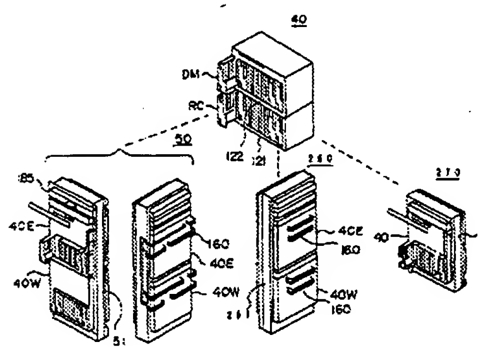


FIG. 11 is a plan view of the alternative embodiment shown in FIG. 10 but in a mated orientation.

DETAILED DESCRIPTION:

(1) DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

(2) Referring to the drawing, and particularly to FIG. 1, an enlarged perspective view of an optoelectronic transceiver module 10 in accordance with the present invention is depicted. The module 10 has a main housing 12 which generally has the shape of an oblong box. The main housing 12 has a generally rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing

US005734558A

United States Patent [19]
Popiawski et al.

[11] Patent Number: 5,734,558
[45] Date of Patent: *Mar. 31, 1998

[54] **REMOVABLE OPTOELECTRONIC MODULE**

[75] Inventors: Daniel S. Popiawski, 22 Woodcliff Rd., Montgomery, IL 60538; James W. McGinley, 102 N. Summit Dr., Schaumburg, IL 60010-6417

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,546,251.

[21] Appl. No.: 488,319

[22] Filed: Jun. 7, 1995

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 417,914, Apr. 6, 1995, and Ser. No. 372,785, Jan. 13, 1995, Pat. No. 5,543,251.

[51] Int. Cl.[6] H05K 5/00
[52] U.S. Cl. 361/752; 361/759; 361/801
[58] Field of Search 361/752-755, 361/796-803, 816, 818; 439/76.1, 131, 132; 385/88-89, 92; 257/432, 433

[56] References Cited

U.S. PATENT DOCUMENTS

4,753,500 6/1988 Iversen et al. 350/96.2
5,515,468 5/1996 DeAndrea et al. 385/88

FOREIGN PATENT DOCUMENTS

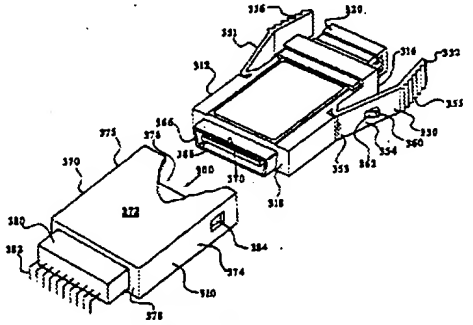
0 422 686 A1 11/1984 European Pat. Off. H05K 5/00

Primary Examiner—Leo P. Picard
Assistant Examiner—Phuong T. Vu
Attorney, Agent, or Firm—David L. Newman

[57] **ABSTRACT**

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material located therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly. The module housing may be pluggable via release levers having detentes received in apertures of a receptacle and a pluggable connector of the module mated within the receptacle.

5 Claims, 5 Drawing Sheets



end 236 of each contact beam 230 resiliently urges against the frontstop 248.

(31) Access for making an electrical connection with the contact beams 230,230 is provided since they protrude from the male ribbon style connector 166 in the area around the bends 238,238. Correspondingly, in order to make an electrical connection between a female ribbon style connector and the resilient male ribbon style connector 166, the distal end 222 of the male ribbon style connector is inserted within a slot provided by the female connector. As the male ribbon style connector 166 is pushed within the female connector, the two rows of contact beams 230,230 will be forced to compress towards each other. In addition, each contact beam 230 will resiliently urge against a corresponding electrical contact mounted within the female ribbon style connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230,230 and the female connector's contact beams.

(32) Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230,230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

(33) An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs . In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374,375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374,375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

(34) The transceiver housing 312 includes a pair of release levers 350,351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350

US005734558A

United States Patent [19]
Poplawski et al.

[11] Patent Number: 5,734,558
[45] Date of Patent: *Mar. 31, 1998

(54) REMOVABLE OPTOELECTRONIC MODULE

[75] Inventors: Daniel S. Poplawski, 22 Woodcliff Rd., Montgomery, IL 60538; James W. McKinley, 101 N. Summit Dr., Schaumburg, IL 60010-6417

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,546,251.

[21] Appl. No.: 488,319

[22] Filed: Jun. 7, 1995

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 417,964, Apr. 6, 1995, and Ser. No. 372,793, Jan. 13, 1995, Pat. No. 5,546,251.

[51] Int. Cl.[6] H04K 3/00

[52] U.S. Cl. 361/752; 361/757; 361/801

[58] Field of Search 361/752-759, 361/796-803, 816, 818; 439/76.1, 131, 133; 385/88-89, 92; 257/432, 433

[56] References Cited

U.S. PATENT DOCUMENTS

4,793,679 12/1988 Isaacson et al. 385/94.1
5,115,466 5/1992 DeAndrea et al. 385/88

FOREIGN PATENT DOCUMENTS

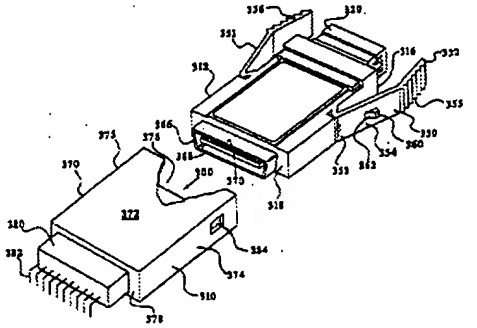
0 422 686 A2 10/1984 European Pat. Off. H05K 5/00

Primary Examiner—Leo P. Picard
Assistant Examiner—Phuong T. Vu
Attorney, Agent, or Firm—David L. Newman

[57] ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly. The module housing may be pluggable via release levers having detents received in apertures of a receptacle and a pluggable connector of the module mated within the receptacle.

8 Claims, 8 Drawing Sheets



12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer

US005717533A

United States Patent [19]
Poplawski et al.

[11] Patent Number: 5,717,533
[45] Date of Patent: *Feb. 10, 1998

[54] REMOVABLE OPTOELECTRONIC MODULE

FOREIGN PATENT DOCUMENTS

OTHER PUBLICATIONS

Related U.S. Application Data

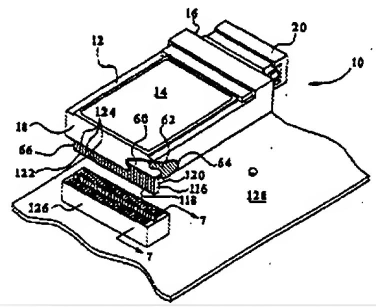
References Cited

U.S. PATENT DOCUMENTS

[57] ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly.

12 Claims, 3 Drawing Sheets



230,230 is provided since they protrude from the male ribbon style connector 166 in the area around the bends 238,238. Correspondingly, in order to make an electrical connection between a female ribbon style connector and the resilient male ribbon style connector 166, the distal end 222 of the male ribbon style connector is inserted within a slot provided by the female connector. As the male ribbon style connector 166 is pushed within the female connector, the two rows of contact beams 230,230 will be forced to compress towards each other. In addition, each contact beam 230 will resiliently urge against a corresponding electrical contact mounted within the female ribbon style connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230,230 and the female connector's contact beams.

(37) Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230,230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

(38) An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs. In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374,375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 maybe a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374,375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

(39) The transceiver housing 312 includes a pair of release levers 350,351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350 includes a second end 352 which includes a gripping portion 355 which has lined edges to assist in gripping of the release lever 350. Intermediate to the first end 353 and the second end 352 is an intermediate portion 354. The

US006551117B2

(12) **United States Patent**
Poplawski et al.

(10) Patent No.: **US 6,551,117 B2**
(45) Date of Patent: ***Apr. 22, 2003**

(54) REMOVABLE TRANSCEIVER MODULE

(73) Assignee: Stratos Lightwave, Inc., Chicago, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(22) Filed: Aug. 1, 2001

(65) Prior Publication Data

Related U.S. Application Data

(56) References Cited

U.S. PATENT DOCUMENTS

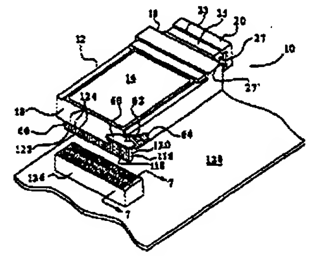
* cited by examiner

Primary Examiner—Tho D. Ta
Assistant Examiner—Edwin A. León
(74) Attorney, Agent, or Firm—Steven M. Evans

(57) ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a circuit board having an optical subassembly mounted thereon. The module housing may be pluggable via a retention member received within the receptacle. The module and receptacle assembly may include grounding members such as a ground clip mounted within a gap provided between the module and a connector port of the receptacle to limit electromagnetic emissions.

41 Claims, 9 Drawing Sheets



19 Claims, 7 Drawing figures

Exemplary Claim Number: 1

Number of Drawing Sheets: 4

BRIEF SUMMARY:

(1) FIELD OF THE INVENTION

(2) This invention relates to connecting both electrical power and optical data signals to a device for receiving and sending such signals over a fiber optic conductor in a optical data signal network or portion thereof; more specifically the invention relates to a plug and receptacle for simultaneously connecting the electrical conductors for supplying electrical power to a using device and aligning and connecting fiber optic conductors to juxtapose the ends of the fiber optic conductors in close proximity, thereby facilitating transmission of optical data signals from one of the fiber optic conductors to another.

(3) BACKGROUND OF THE INVENTION

(4) Many data processing and transmission devices, especially personal computers, are electrically powered by connections to standard household receptacles and also are networked or interconnected by wide area and local area networks with other computers, servers and related data processing and transmission devices. This permits the rapid and accurate interchange of data between interconnected computers.

(5) Typically, the higher capability computers are networked or interconnected over a network at least some of which is comprised of fiber optic transmission lines; the lower capability computers are interconnected to networks through an electrical data connection, and the electrical signal may be further converted to an optical signal by converters or transceivers within the network.

(6) Optical signals have vast advantages over digital or analog electrical signals because optical signals are not affected by electrical interference from other electrical or electronic devices positioned close to the optical fiber data transmission lines and the data bandwidth of optical conductors is much greater than corresponding electrical conductors, thereby permitting the rapid transmission of much larger amounts of data.

(7) As the cost of electronic to optical and optical to electronic conversion devices or transceivers are reduced with wider spread usage and the speeds of data transmission are increased, it is highly desirable to carry the optical signal as close to the using device as possible. This necessitates the optical signal transmitting fiber optic conductors must be easily and reliably connected to the fiber optic conductor network; typically, this is accomplished with a specialized connector on the ends of two fiber optic cables. The electrical power connections for the devices have remained relatively standard.

(8) In the future, it is anticipated that computers and servers and related data using or transmitting devices will be designed with optical signal capability. Moreover, "dumb" devices (those which do not use external data), such as home heating and air conditioning units, toasters, coffee makers, and other household appliances that presently do not use optical signals for their external control data input such as televisions will either incorporate optical signal capability in their functions or be controllable by programable

US006533466B1

(12) United States Patent
Smith

(10) Patent No.: US 6,533,466 B1
(45) Date of Patent: Mar. 18, 2003

(54) HYBRID CONNECTOR ASSEMBLY FOR ELECTRICAL CONDUCTORS AND FIBER OPTIC DATA CONDUCTORS

(75) Inventor: Gordon James Smith, Rochester, MN (US)

(73) Assignee: International Business Machines Corporation, Armonk, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 27 days.

(21) Appl. No.: 09/836,918

(22) Filed: Sep. 3, 2000

(51) Int. Cl.[7] G02B 6/38

(52) U.S. Cl. 385/78; 385/92; 439/108; 439/577; 439/551

(58) Field of Search 385/75-77, 78, 88/64; 439/108, 107, 577, 551

(56) References Cited

U.S. PATENT DOCUMENTS

4,486,072 A * 12/1984 Roberts 385/64
4,767,181 A * 8/1988 McDevitt 350/78
5,498,851 A * 12/1995 Schlemmer et al. 385/75
5,907,640 A * 10/1999 Ross et al. 439/577

6,200,139 B1 * 3/2001 Bradley et al. 439/620

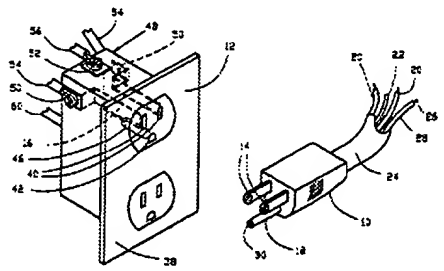
* cited by examiner

Primary Examiner—Hemang Sanghavi
Assistant Examiner—Scott Kugler
(74) Attorney, Agent, or Firm—Lawrence R. Laseo

(57) ABSTRACT

A combination or hybrid connector, for connecting both an electrical connection and an optical signal connection simultaneously therebetween a fiber optic conductor aligned with and contained within the ground pin of an electrical power plug. A fiber optic conductor is contained within a mating receptacle unit to which the electrical power is plug connected. The fiber optic conductor of the plug extends beyond the ground pin to enter, be aligned and interface with a fiber optic conductor within the receptacle unit. The end of the fiber optic conductor in the plug is shielded and the shield is retractable upon engagement with the alignment device. The alignment device is fabricated to have a converging interior space which receives the fiber optic conductor of the plug and gently feeds the plug fiber optic conductor to an aligned position to place the end thereof closely juxtaposed with the end of the fiber optic conductor of the receptacle. The shield is self-operating so that upon disengagement of the plug from the receptacle the shield extends or restores to its original form again to shield the fiber optic conductor extending from the ground pin.

19 Claims, 4 Drawing Sheets



(7) U.S. Pat. No. 5,434,398 uses a magnetic encoding process to establish the identity with a card based system. Modulated magnetic fields embedded in a smart card require the use of a ferromagnetic element to retain the unique identity code. A magnetic reader decodes the card information allowing system activation. Exposure of this system to radio frequency energy used in electrosurgery, could effect the integrity of the magnetic smart card and degrade the ability of the magnetic based card reader to accurately decode its proper identity. Radio frequency energy would remagnetize both the smart card and reader by induced magnetic coupling to the ferromagnetic elements. Clearly this system would require magnetic shielding to retain identity data. Indeterminate magnetic sources present in the operating room also creates additional major problems for this system and would make its use in electrosurgery suspect.

(8) U.S. Pat. No. 5,396,062 describes a power source receptacle system with detection of the presence of a mated plug, by using an optical coupling technique, established by beam passage through the receptacle. This approach uses a light emitter to generate a beam, that passes through openings in the receptacle contacts, to a receiver aligned on a dedicated optical axis. A powered instrument having a bladed plug for insertion in a receptacle breaks the beam transmission path sending a corresponding signal to a controller that detects the plug engagement. The '062 patent is limited in use, in that, it provides for detection when a mating plug is either inserted or removed from the receptacle. Power can only be activated or deactivated in the receptacle, based on whether the mating plug is engaged or disengaged. Numerous problems are presented by this system. First, the identity is not recognized or associated to a given instrument plugged into the receptacle. Second, the power applied to the receptacle cannot be differentiated between specific pluggable instruments. Also, additional problems are presented, because a specific optical axial alignment is required for beam passage, through the openings in the power receptacle contacts, thereby requiring a specific mechanical alignment integrity.

(9) U.S. Pat. No. 5,625,370 has an electromagnetic device and method in an identification system apparatus. An electrically conductive material is disposed to pass through a magnetic flux loop of the electromagnetic device. The coupling established between those components is the means by which identification information is transferred. An antenna may also be electrically connected to the conductive material to augment the apparatus for receiving transmitted identification information. Multiple identification problems exist with radio frequency based equipment due to radiation coupling with the electromagnetic conductive strip and antenna which will deteriorate the identity signals. Error borne signals lose their identity and become inaccurate with decoding. The radio frequency energy may also electromagnetically couple to distort the magnetic flux loop of the electromagnetic device. This will reduce the signal to noise ratio during information transfer and lower the accuracy of the identity information recovered.

(10) International Patent WO9608794 has a security code identification circuit that uses a radio frequency based card reader and decoder method to recover a digital security code. The card reader includes a receiving antenna sensitive to a signal generated to an access card. A receiver circuit is coupled to the receiving antenna to detect and process an analog signal that is then converted to a digital security code. A problem with this type of recognition system makes it error borne and unacceptable for code identification in radio frequency systems. Radio frequency energy contains components that will be picked up and coupled by the reader receiving antenna as it is sensitive to those frequencies. This will confuse the card reader

(12) **United States Patent**
Orszulak et al.

(10) Patent No.: US 6,402,743 B1
(45) Date of Patent: Jun. 11, 2002

(54) **SMART RECOGNITION APPARATUS AND METHOD**

(75) Inventors: James Harry Orszulak, Nederland; Gary Lee Dobbins, Jr., Longmont, both of CO (US)

(73) Assignee: Sherwood Services AG, Schaffhausen (CH)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/528,388

(22) Filed: Mar. 17, 2000

Related U.S. Application Data

(60) Continuation of application No. 08/958,362, filed on Dec. 12, 1997, now Pat. No. 6,265,827.

(51) Int. Cl.[7] A61B 18/04; A61B 18/18

(52) U.S. Cl. 606/34; 606/41; 607/101

(58) Field of Search 606/34, 37, 1, 606/4, 10-12, 41-52; 607/1, 98, 100-102, 113

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,905,691 A * 3/1990 Arzt et al. 606/145
5,117,819 A 10/1992 Schaefer et al.
5,343,138 A 8/1994 Ehlrner et al.
5,395,082 A 3/1995 Zimmerer et al.
5,400,267 A 3/1995 Denen et al.
5,413,573 A 5/1995 Koivukangas
5,430,338 A 7/1995 Gudaitis
5,605,150 A 2/1997 Radons
5,625,370 A 4/1997 D'Hont
5,651,783 A 7/1997 Reynard
5,660,567 A 8/1997 Nierlich
5,693,043 A * 12/1997 Kittrell et al. 606/10
5,694,936 A * 12/1997 Fujimoto et al. 606/10

FOREIGN PATENT DOCUMENTS

WO WO 96/08794 3/1996

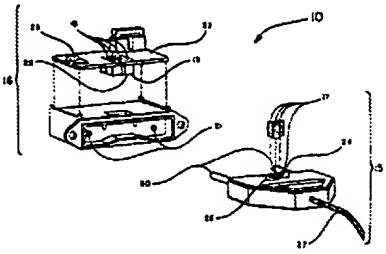
* cited by examiner

Primary Examiner—Ray Cohen

(57) **ABSTRACT**

A qualifying connection for an instrument electrically connects a source of electrosurgery energy and to the instrument and has first and second parts coupled to the instrument and the source, respectively. Optical couplings on the connection transmit invisible energy to identify the instrument and are positioned on the first and second parts. A light modifier on the first part is positioned to the second part for modification of radiation in the infrared wavelengths so infrared transmitted encoded signals and non-encoded encoded proximity detectors on the second part are the coupled detectors. Mechanical attachments include mating male and female portions physically extending between the parts for mating engagement. An identifying circuit couples to the second part and responds to invisible light optically communicated across the couplings for verifying the type of instrument connected by the cable to the source. A method of using the connection has steps including interpreting and configuring the parts with attachments and couplings for transmitting invisible optical energy to identify the instrument. The method includes modifying the invisible optical energy with geographically disposed proximate couplings of the parts when the attachments engage and the couplings are positioned. Passing said encoding signals of the modified energy are transmitted through the connection and to an identifying circuit in the source.

18 Claims, 2 Drawing Sheets



(36) Access for making an electrical connection with the contact beams 230,230 is provided since they protrude from the male ribbon style connector 166 in the area around the bends 238,238. Correspondingly, in order to make an electrical connection between a female ribbon style connector and the resilient male ribbon style connector 166, the distal end 222 of the male ribbon style connector is inserted within a slot provided by the female connector. As the male ribbon style connector 166 is pushed within the female connector, the two rows of contact beams 230,230 will be forced to compress towards each other. In addition, each contact beam 230 will resiliently urge against a corresponding electrical contact mounted within the female ribbon style connector. Thus, an electrical connection will be formed between the male ribbon style connector's electrical contact beams 230,230 and the female connector's contact beams.

(37) Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230,230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

(38) An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs . In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374,375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374,375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

(39) The transceiver housing 312 includes a pair of release levers 350,351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350

US006267606B1

(12) **United States Patent**
Poplawski et al.

(10) Patent No.: US 6,267,606 B1
(45) Date of Patent: *Jul. 31, 2001

(54) **REMOVABLE TRANSCEIVER MODULE AND RECEPTACLE**

(75) Inventors: Daniel S. Poplawski, Montgomery; Patrick B. Gilliland, Chicago; James W. McGinley, Barrington Hills, all of IL (US)

(73) Assignee: Stratos Lightwave, Inc., Chicago, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 09/288,743

(22) Filed: Apr. 30, 1999

Related U.S. Application Data

(63) Continuation of application No. 08/937,202, filed on Sep. 12, 1997, which is a continuation of application No. 08/438,857, filed on Oct. 4, 1995, now Pat. No. 5,684,698, which is a continuation of application No. 08/313,818, filed on Sep. 15, 1994, which is a continuation-in-part of application No. 08/082,491, filed on Jun. 7, 1993, now Pat. No. 5,734,558, which is a continuation-in-part of application No. 08/017,814, filed on Apr. 6, 1993, now Pat. No. 5,319,528, which is a continuation-in-part of application No. 07/972,707, filed on Jan. 13, 1992, now Pat. No. 5,363,231.

(51) Int. Cl.[7] H01R 13/633

(52) U.S. Cl. 439/92; 361/752; 361/753

(58) Field of Search 439/92, 85, 108, 439/108, 107; 385/92; 361/752, 753, 754, 802

(56) **References Cited**

U.S. PATENT DOCUMENTS

Re. 32,523 9/1987 Kumar 439/92
2,897,469 8/1959 Johnson 339/91
3,364,451 1/1968 Ehrfeld 339/176

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

4339126 A1 11/1993 (DE) .
0 228 274 11/1986 (EP) .
0 361 65 A2 10/1990 (EP) .
0 502 113 A2 2/1992 (EP) .
413 459 A2 6/1990 (EP) .

(List continued on next page.)

OTHER PUBLICATIONS

Stratos Specifications ES9211-XC.

HP Module HFBR-5103, FDDI Data Sheet.

An optical Data Link using a CD laser.

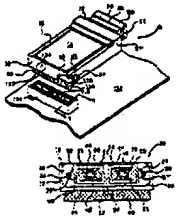
(List continued on next page.)

Primary Examiner—Paula Bradley
Assistant Examiner—Edwin A. Leon
(74) *Attorney, Agent, or Firm*—David L. Newman

(57) **ABSTRACT**

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a circuit board having an optical subassembly mounted thereon. The module housing may be pluggable via a receptacle member received within the receptacle. The module and receptacle assembly may include grounding means such as a ground clip mounted within a gap provided between the module and a component part of the receptacle to limit electromagnetic emissions.

36 Claims, 9 Drawing Sheets



generally has the shape of an oblong box. The main housing 12 has a generally rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 45 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug . Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

US006201704B1

(12) United States Patent
Poplawski et al.

(10) Patent No.: US 6,201,704 B1
(45) Date of Patent: *Mar. 13, 2001

(54) TRANSCEIVE MODULE WITH EMI SHIELDING

(75) Inventors: Daniel S. Poplawski, Montgomery; James W. McGinley, Schaumburg, both of IL (US)

(73) Assignee: Stratos Lightwave, Inc., Chicago, IL (US)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 08/872,319

(22) Filed: Jun. 10, 1997

Related U.S. Application Data

(63) Continuation of application No. [illegible], and a continuation-in-part of application No. [illegible], now Pat. No. [illegible].

(51) Int. Cl.⁷ [illegible]
(52) U.S. Cl. [illegible]
(58) Field of Search [illegible]

(56) References Cited

U.S. PATENT DOCUMENTS

[illegible]

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

[illegible] (DE).
[illegible] (EP).

(List continued on next page.)

OTHER PUBLICATIONS

Gwinner, D, "Vacuum Evaporated Al for Selective Shielding of Plastic Housings", Conductive Coatings, 1973.*

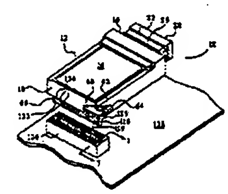
(List continued on next page.)

Primary Examiner—Jeffrey Gaffin
Assistant Examiner—Phuong Vu
(74) Attorney, Agent, or Firm—David L. Newman

(57) ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly mounted thereon. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly.

31 Claims, 4 Drawing Sheets



(3) Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

(4) In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

(5) Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

(6) The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

(7) Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a poring box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

(8) Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

(9) In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

(10) Referring to FIG. 4, an enlarged perspective view of the optoelectronic module's potting box 64 is depicted. The potting box 64 forms the outer housing of the optoelectronic module. Thus, the potting box generally has the

FIG.1

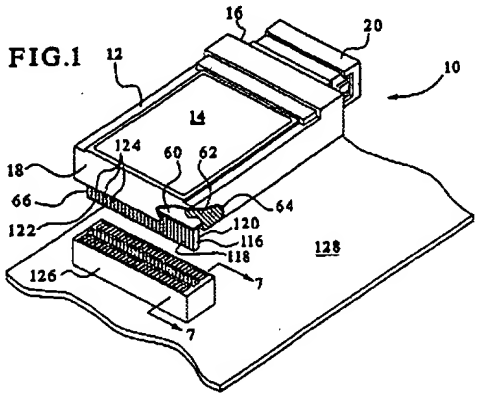
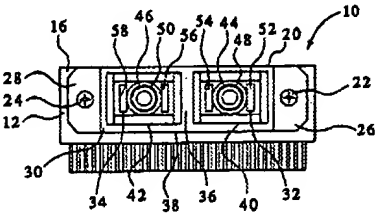


FIG.2



800 MHz and 900 MHz spread-spectrum RF signals are in wide use for this purpose. Because of the short distances normally involved in the present invention, amplitude-modulated infrared (IR) beams also serve well. In this case, a conventional, very inexpensive infrared emitter and photodetector substitute for RF antenna 233. The invention contemplates the use of any other shortrange, low-power wireless technologies as well.

(11) FIG. 2D shows a base station 240 packaged in a single physical module or enclosure 241. This module has an enclosure 241 adapted to sit in a small area of a desktop, shelf, or similar space; its internal circuits occupy no more volume than those of cards 220 or 230. Antenna 242 radiates and receives RF energy representing digital data from and to the base station. The wireless communications data format and signal type matches those of remote station 230. Therefore, any of the modalities employed there are useful here. For example, an IR emitter/detector may replace RB antenna 242. A conventional wall-wart power supply plugs into an AC power line to provide low-voltage direct-current power to the base station via cord 244. PCMCIA slot 245 accepts modem card 220, shown in dotted lines. Its telephone jack 223 connects to a telephone-system wall outlet as described above.

(12) FIG. 2E shows an alternative form 250 of the base station. Here, the enclosure 251 also incorporates a power transformer, and connects directly to an AC outlet via plug 252 and cord 253. Modem 220 plugs into PCMCIA slot 254. In this embodiment, modem 220 sends and receives telephone signals via its PCMCIA connector from a telephone jack 255 physically mounted in enclosure 251. Jack 255 then connects to the telephone system. Antenna 256 exchanges RF, optical, or other wireless signals in the same manner as antenna 242, FIG. 2C.

(13) FIG. 3 is a block-diagram rendering of the interconnection of the components shown in FIG. 2.

(14) FIG. 3A illustrates a wired configuration wherein computer 210 attaches directly to modem 220, which in turn transfers data by a wire to telephone system 360. Computer interface connector 154 delivers data to mating interface connector 222 of modem 220. This data normally takes the form of a bitstream in RS-232 format or some other conventional format. This form is termed "baseband" herein, because the data has a more or less raw form; however, this term is intended to include any data format in which a computer delivers data to a modem for further transmission to an external network.

(15) Block 321 converts the baseband data from connector 222 to modulated form according to any of the numerous protocols from manufacturers and from the international standards organization CCITT, such as V.42, V42bis, V.fast, etc. Although this modulated data is called "CCITT data" herein, that term is to be understood as encompassing all forms of data adapted to be transmitted on system 360; for example, an Integrated Services Digital Network (ISDN) system employs a high-speed unmodulated bitstream divided into multiple channels. Some implementations of conventional block 321 employ hard-wired circuits, the most common present-day converter is a single-chip programmed digital signal processor. Block 322 realizes a conventional data access arrangement (DAA) for modifying the electrical parameters the CCITT data to those of system 360, and for protecting system 360 against harm from any malfunction of modem 220. DAA 322 transfers data to and from a standard connector such as RJ11 plug 223. As mentioned earlier, other forms of connector are also available, and may be preferred in some embodiments. In fact, some modems may include multiple plugs, such as the X-jack connector shown at 323.

(16) Controller block 323 implements conventional flow-control and housekeeping functions; it can be hardwired or programmable. Block 324 optionally converts baseband data to and from a standard RS-232 format.

FIG. 2D

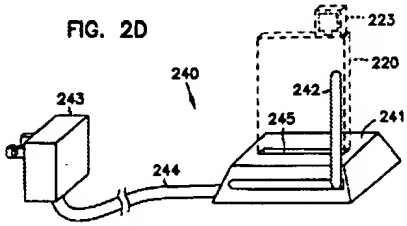
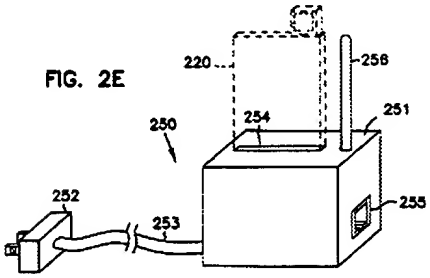


FIG. 2E



PAT-NO: JP363124009A

DOCUMENT-IDENTIFIER: JP 63124009 A

TITLE: MULTICORE OPTICAL ROTARY CONNECTOR

PUBN-DATE: May 27, 1988

INVENTOR-INFORMATION:
NAME
TACHIBANA, MAKOTO

ASSIGNEE-INFORMATION:
NAME COUNTRY
TATSUTA ELECTRIC WIRE & CABLE CO LTD N/A

APPL-NO: JP61272078

APPL-DATE: November 13, 1986

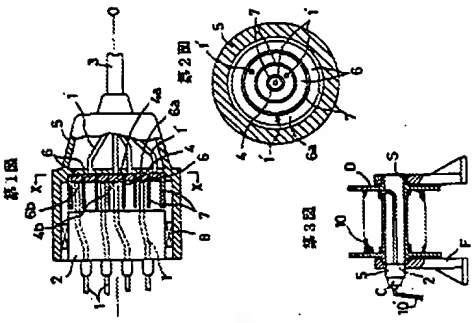
INT-CL (IPC): G02B006/36

US-CL-CURRENT: 385/59

ABSTRACT:

PURPOSE: To decrease the transmission influence caused by a shift of an optical axis, and also, to reduce the cost of equipment of the whole transmission system by attaching a rotating side member onto the same axis against a fixing side member, and providing plural different diameter annular surface light receiving (emitting) elements.

CONSTITUTION: A plug 2 is fitted and attached rotatably to a receptacle 5 through a bearing 8. A cable including four pieces of optical fibers 1 is led to the plug 2, and to the receptacle 5, a signal cable 3 including four pieces of lead wires 1' of receiving and sending electric signals of light receiving and emitting elements is connected. On the surface vertical to a revolving shaft '0' in the receptacle 5, a light receiving and emitting diode 4 on the shaft '0' and three pieces of different diameter annular surface light receiving (emitting) diodes 6 using said diode as an axis center are stuck. The diodes 4, 6 consist of light receiving (emitting) diode elements, and a lead wire 1' is connected to connecting surfaces 4a, 6a. Also, the fiber 1 is led to light receiving and emitting surfaces 4b, 6b of the diodes 4, 6 and its end faces are opposed. In such a way, an optical -electric conversion is executed without using separately a converter.



ribbon style connector's electrical contact beams 230,230 and the female connector's contact beams.

[0085] Similarly, to disconnect the resilient male ribbon style connector 166 from the female connector, the male connector is simply pulled from the female connector. Once the male ribbon style connector 166 has been removed, the contact beams 230,230 will resiliently regain the configuration of FIG. 9, whereby the second end 236 of each contact beam will abut its corresponding frontstop 248.

[0086] An alternative embodiment of the present invention is shown in FIG. 10 having a main housing 312, having a first end 316 and a second end 318. As discussed in the previous embodiments, the housing 312 includes optical subassemblies for sending transmission over a data link and receiving transmissions over a data link. The preferred embodiment is an optoelectronic transceiver, however, a simplex transmitter or receiver or multiple transmitters or receivers may be incorporated in the module housing of the alternative embodiment. At the first end 316 is a transceiver connector 320 for receiving fiber optic plugs . In an alternative embodiment, optical fibers may be directly attached to the module and the optical subassemblies therein. At the second end 318 is a pluggable connector 366. In the preferred embodiment, the pluggable connector 366 is a D-shaped connector having a printed circuit board 368 having multiple contact traces 370 adhered thereto. The transceiver housing 312 is pluggable into receptacle 310 and is inserted into the receptacle 310 in direction of arrow 300. The receptacle 310 includes a receptacle housing 370 having a top 372 and sides 374,375. The receptacle housing 370 includes an open end 376 and a closed end 378. At the closed end 378 of the receptacle housing 370 is a connector 380 for mating with the pluggable connector 366. The connector 380 protrudes into the interior the receptacle housing 370 and has an aperture for receiving the pluggable connector 366 of the transceiver housing 312. In the preferred embodiment, the connector 380 is a female connector for receiving the male connector 366. However in an alternative embodiment, the pluggable connector 366 of the transceiver housing 312 may be a female connector and the connector 380 of the receptacle housing 370 would be a male connector. Protruding from the connector 380 are contacts 382 for direct connecting to a printed circuit board in a peripheral device such as a work station or computer to wire the connector 380 directly to traces of a printed circuit board. In an alternative embodiment, a flat ribbon cable for transmitting the electrical signals protrudes from the transceiver module. The receptacle housing 370 includes in sides 374, 375 aperture 384 for providing the locking of the transceiver within the receptacle housing 370.

[0087] The transceiver housing 312 includes a pair of release levers 350,351. The description of release lever 350 is the same of that for 351. The release lever 350 includes a first end 353 which is attached to the side of the transceiver housing 312. In a preferred embodiment, the release lever 350 is integrally molded with the transceiver housing 312. The release lever 350 includes a second end 352 which includes a gripping portion 355 which has lined edges to assist in gripping of the release lever 350. Intermediate to the first end 353 and the second end 352 is an intermediate portion 354. The intermediate portion 354 angles outwardly away from the sides of the transceiver housing 312. Attached at the end of the intermediate portion 354 is the second end 352 which is generally parallel to the side of the transceiver housing 312. However, as the intermediate portion 354 angles outward and away from the side of the transceiver housing 312, the second end 352 is at a distance from the sides of the transceiver housing 312 in its normated condition. Protruding from the intermediate portion 354 is detente 360. The detente 360 includes an engagement surface 362. Upon insertion of the transceiver housing 312 into the receptacle 370, the intermediate portion

US 20020142634A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2002/0142634 A1

Pepiswald et al. (43) Pub. Date: Oct. 3, 2002

(54) REMOVABLE TRANSCEIVER MODULE AND RECEPTACLE

(76) Inventors: Daniel S. Pepiswald, Montgomery, IL (US); James W. McGinley, Schaumburg, IL (US)

Correspondence Address:
Steven M. Evans
Stratos Lightwave, Inc.
7444 West Wilson Avenue
Chicago, IL 60706 (US)

(21) Appl. No.: 10/154,658

(22) Filed: May 24, 2002

Related U.S. Application Data

(63) Continuation of application No. 08/515,613, filed on Aug. 16, 1995, which is a continuation-in-part of application No. 08/485,310, filed on Jun. 7, 1995, now Pat. No. 5,734,558, and which is a continuation-in-part of application No. 08/417,914, filed on Apr. 6, 1995, now Pat. No. 5,717,553, and which is a continuation-in-part of application No. 08/372,980, filed on Jan. 13, 1995, now Pat. No. 5,644,581.

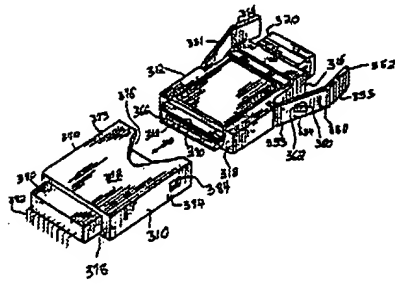
Publication Classification

(51) Int. Cl.[7] H01R 4/66

(52) U.S. Cl. 439/98

(57) ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a potting box with potting material inserted therein. In addition, a circuit board is encased by the potting material. The circuit board has an optical subassembly connected thereto. The optical subassembly extends outside of the potting box through a recess. Correspondingly, a recess cover is provided for forming a liquid tight seal between the recess cover, the potting box, and the optical subassembly. The module housing may be pluggable via release levers having detentes molded in apertures of a receptacle and a pluggable connector of the module mated within the receptacle. The receptacle may include grounding means such as a ground clip mounted within the receptacle and a protective door to limit electromagnetic emissions.



rectangular top 14 with a first end 16 and an opposite second end 18 extending perpendicularly from the top. Attached to the first end 16 of the main housing 12 is a transceiver connector 20 for receiving fiber optic plugs.

[0080] Turning to FIG. 2, a front view of the optoelectronic transceiver module 10 is depicted. The transceiver connector 20 is attached to the first end 16 of the main housing 12 by two screws 22,24. The two screws 22,24 extend through the transceiver connector's mounting ears 26,28 and into the main housing 12. Extending perpendicularly from the mounting ears 26,28 is a generally rectangularly shaped connector shell 30. The connector shell 30 provides two receptacles 32,34 for receiving fiber optic connector plugs. The receptacles 32,34 are formed by the connector shell 30 along with a divider wall 36 which extends along the center of the connector shell. Furthermore, located in the bottom 38 of each receptacle 32,34 is a keying channel 40,42 which extends toward the first end 16 of the main housing.

[0081] In the preferred embodiment, the receptacles 32,34 of the connector shell 30 are specifically dimensioned to receive an SC duplex plug. Therefore, the keying channels 40,42 ensure that an SC plug will be inserted so that receptacle 32 will only accept a plug for sending data and receptacle 34 will only accept a plug for receiving data.

[0082] Extending from the main housing 12 and into each of the receptacles 32,34 is an optical subassembly 44,46. As previously indicated, the optical subassembly 44 is for sending transmissions over a data link and the optical subassembly 46 is for receiving transmissions over a data link. In order to facilitate the connection between the transceiver 10 and the data links, each optical subassembly has a ferrule receiving portion 48,50. The ferrule receiving portion 48,50 couples with the SC plug. Furthermore, the transceiver's latch members 52,54,56, and 58 firmly hold the SC plug in contact with connector 20.

[0083] The actual sending and receiving of optically encoded data is performed by a laser diode within the optical subassembly 44 and a photo diode within the optical subassembly 46. Both the laser diode and the photo diode are electrically connected to a circuit board which is mounted within the main housing 12.

[0084] Turning back to FIG. 1, a portion of the circuit board 60 is depicted. Incorporated onto the circuit board 60 is circuitry for transmitting and receiving optically encoded data (circuitry not shown). The circuit board 60 is encased in potting material 62 and a potting box 64 which forms the main housing 12. The potting material 62 encases the circuit board 60 such that only the circuit board's male ribbon style connector 66 extends from the potting material 62.

[0085] Turning to FIG. 3, a perspective view of the bottom 68 of the transceiver module 10 is depicted. In the preferred embodiment, the bottom 68 has two mounting ports 70,70 which are adjacent to the first end 16 of the main housing 12. In addition, the male ribbon style connector 66 protrudes perpendicularly from the bottom 68 and is adjacent to the second end 18 of the main housing 12.

[0086] In an alternative embodiment, the ribbon style connector 66 may protrude perpendicularly from the second end 18 of the module 10 so that it can be connected to a circuit card assembly in a direction which is parallel to the direction of insertion of the optic plugs into the module's receptacles. However, in this alternative embodiment, another recess cover will be needed in order to prevent potting material from escaping the second end of the potting box.

US 20020009905A1

olted States
tent Application Publication (10) Pub. No.: US 2002/0009905 A1
ilawski et al. (43) Pub. Date: Jan. 24, 2002

OVABLE TRANSCEIVER MODULE AND CEPTACLE

ntors: Daniel S. Pepkowski, Montgomery, IL (US); Patrick B. Gilliland, Chicago, IL (US); James W. McGinley, Barrington Hills, IL (US)

rrespondence Address:
ert M. Evans
ior Patent Attorney
RATOS LIGHTWAVE, INC.
d West Wilson Avenue
icago, IL 60640 (US)

ignee: Stratos Lightwave, Inc.

l No.: 09/928,421

d: Aug. 1, 2001

Related U.S. Application Data

ntinuation of application No. 08/295,743, filed on 30, 1999, now Pat. No. 6,287,604, which is a ntinuation of application No. 08/097,210, filed on 13, 1996, now Pat. No. 5,530,876, which is a ntinuation of application No. 08/336,897, filed on Oct. 4, 1995, now Pat. No. 5,564,468, which is a continuation-in-part of application No. 08/311,813, filed on Aug. 18, 1995, which is a continuation-in-part of application No. 08/285,310, filed on Aug. 7, 1998, now Pat. No. 5,734,555, which is a continuation of application No. 08/118,814, filed on Aug. 7, 1995, now abandoned and which is a continuation of application No. 08/372,780, filed on Jan. 13, 1995, now Pat. No. 5,546,281.

Publication Classification

(51) Int. Cl.[7] H04B 1/00
(52) U.S. Cl. 455/63

(57) ABSTRACT

A robust optoelectronic transceiver module which is quick, easy, and inexpensive to manufacture. The transceiver module has a main housing which consists of a circuit board having an optical subassembly mounted thereon. The module housing may be pluggable via a receptacle member received within the receptacle. The module and receptacle assembly may include grounding means such as a ground clip mounted within a gap provided between the module and a connector port of the receptacle to limit electromagnetic emissions.